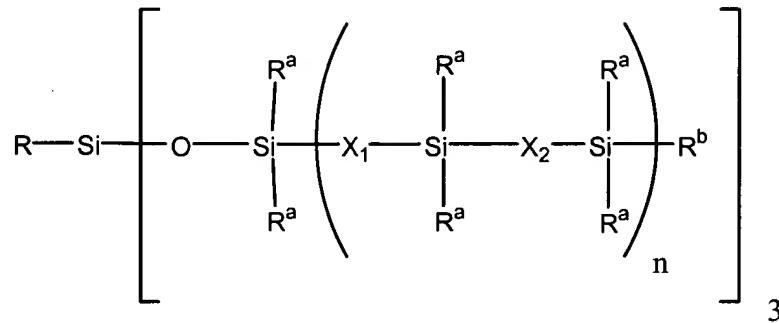


CLAIMS

What is claimed is:

5 1. A compound represented by the following structural formula:



wherein:

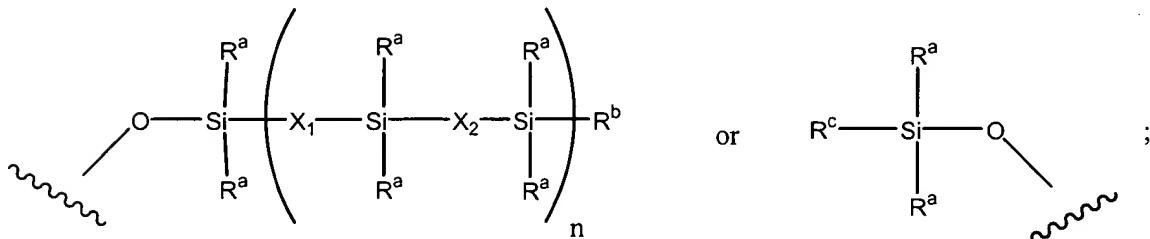
10 X_1 and X_2 are independently each an inert linking group;

each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group;

15 n is 1, 2, 3 or 4;

R is a substituted or unsubstituted aliphatic group, a substituted or unsubstituted aryl group or is represented by a structural formula selected from:

15



each R^b is independently an epoxide substituted aliphatic group; and

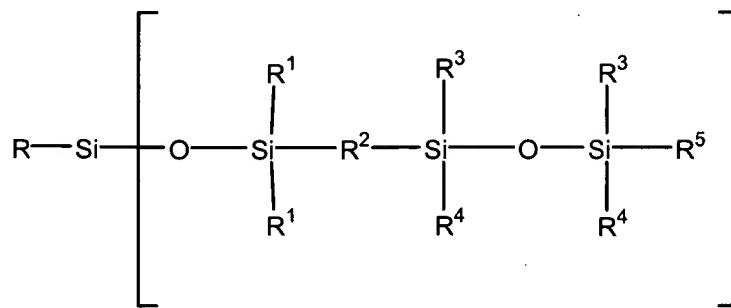
20 R^c is H, an unsubstituted aliphatic group, a substituted aliphatic group, an unsubstituted aryl group, a substituted aryl group, a substituted siloxane group, an unsubstituted siloxane group, a substituted polysiloxane group or an

unsubstituted polysiloxane group.

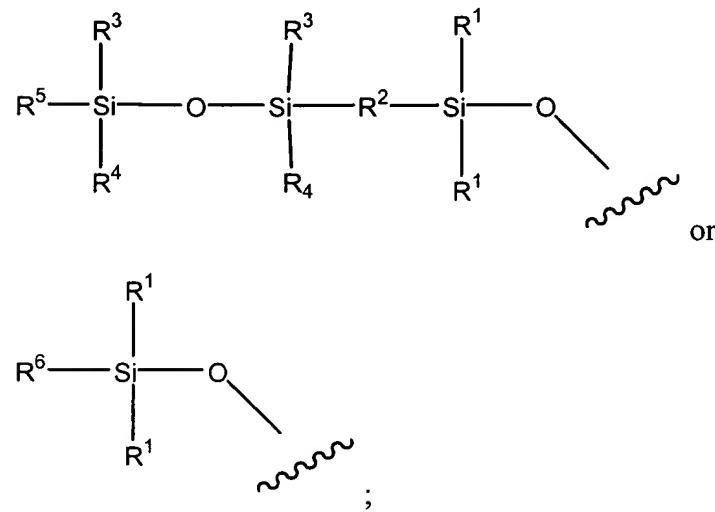
2. The compound of Claim 1 wherein the compound is represented by the following structural formula:

5

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wherein R is represented by a structural formula selected from:



wherein:

10 each group R¹, each group R³ and each group R⁴ is independently a substituted or unsubstituted C₁-12 alkyl, C₁-12 cycloalkyl, aryl substituted C₁-12 alkyl or aryl group;

each group R² is independently a substituted or unsubstituted C₁-12 alkylene, C₁-12 cycloalkylene, C₁-12 arylalkylene, or arylene group, -Y₁-[O-Y₁]_p-, -Y₁-Si(R^z)₂-Y₁-, -Y₁-Si(R^z)₂-Y₁-O-Y₁-Si(R^z)₂-Y₁-, or -Y₁-Si(R^z)₂-Y₁-Si(R^z)₂-Y₁-;

15

each group R⁵ is independently, an epoxide substituted aliphatic group having 2-10 carbon atoms; and

each group R⁶ is independently hydrogen, an alkenyl, a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂-alkyl or aryl or R^z-(O-Y₁)_m-, (R^z)₃Si-(O-Si(R^z)₂)_q-Y₁- or (R^z)₃Si-(O-Si(R^z)₂)_q-O-;

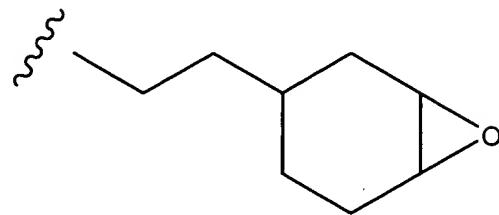
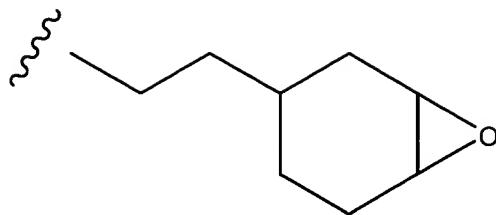
5 each R^z is independently a substituted or unsubstituted C₁₋₁₂ alkyl group, C₁₋₁₂ cycloalkylalkyl group, aryl substituted C₁₋₁₂ alkyl group or aryl group;

each Y₁ is independently a C₁₋₁₂ alkylene group;
10 p is an integer from 1 to 5; m is an integer from 1 to 10; and q is an integer from 0 to 4.

3. The compound of Claim 2 wherein each group R² is independently, a substituted or unsubstituted C₁₋₁₂ alkylene, C₁₋₁₂ cycloalkylene, C₁₋₁₂ substituted arylalkylene, or arylene group; and each R⁶ is independently a substituted or unsubstituted C₁₋₁₂ alkylsilane, C₁₋₁₂ cycloalkylsilane, C₁₋₁₂ alkoxysilane, aryl substituted C₁₋₁₂ alkylsilane, a hydrogen, a vinyl, a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ dialkylether, (C₁₋₁₂ cycloalkyl)C₁₋₁₂ alkylether, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂ alkyl or aryl group.

15 20 4. The compound of Claim 3 wherein at least one R⁵ comprises a cycloalkene oxide.

25 5. The compound of Claim 3 wherein each R⁵ is represented by the following structural formula:

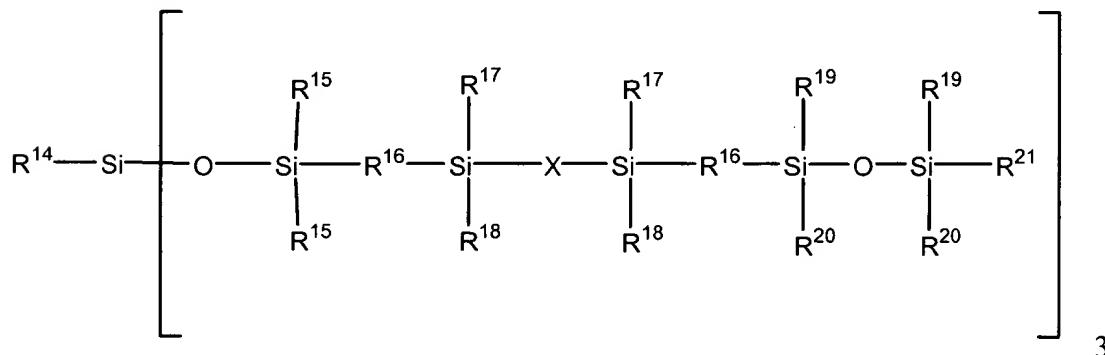


6. The compound of Claim 3 wherein R^1 is a methyl group; each group R^2 is an ethylene, hexylene, or octylene group; each group R^3 is a methyl group; each group R^4 is a methyl group; each group R^5 is a 2-(3,4-epoxycyclohexyl) ethyl grouping, and each group R^6 is a hydrogen or ethenyl.

5

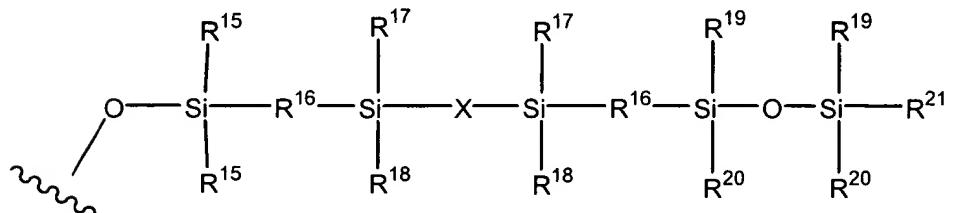
7. The compound of Claim 1 wherein the compound is represented by the following structural formula:

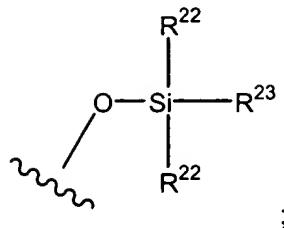
10



3

wherein R^{14} is represented by a structural formula selected from:





each group R¹⁵, each group R¹⁷, each group R¹⁸, each group R¹⁹, each group R²⁰ and each group R²² is independently a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂ alkyl or aryl group;

5 each group R¹⁶ is independently a substituted or unsubstituted C₁₋₁₂ alkylene, C₁₋₁₂ cycloalkylene, C₁₋₁₂ arylalkylene, or arylene group, -Y₁-[O-Y₁]_p-, -Y₁-Si(R^z)₂-Y₁-, -Y₁-Si(R^z)₂-Y₁-O-Y₁-Si(R^z)₂-Y₁-, or -Y₁-Si(R^z)₂-Y₁-Si(R^z)₂-Y₁-;

10 each R²¹ is independently an epoxide substituted aliphatic group having 2-10 carbon atoms;

R²³ is independently hydrogen, an alkenyl, a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂-alkyl or aryl or R^z-(O-Y₁)_m-, (R^z)₃Si-(O-Si(R^z)₂)_q-Y₁- or (R^z)₃Si-(O-Si(R^z)₂)_q-O-;

15 each group X is independently oxygen or R¹⁶;

each R^z is independently a substituted or unsubstituted C₁₋₁₂ alkyl group, C₁₋₁₂ cycloalkylalkyl group, aryl substituted C₁₋₁₂ alkyl group or aryl group;

each Y₁ is independently a C₁₋₁₂ alkylene group;

p is an integer from 1 to 5; m is an integer from 1 to 10; and q is an integer from 0 to 4.

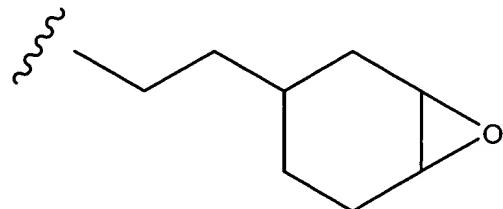
8. The compound of Claim 7 wherein each group R¹⁶ is independently a substituted or unsubstituted C₁₋₁₂ alkylene, C₁₋₁₂ cycloalkylene, aryl substituted C₁₋₁₂ alkylene or arylene group; R²³ is, independently, a hydrogen, a monovalent substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ dialkylether

(alkyl-O-alkylene-), C₁₋₁₂ cycloalkyl C₁₋₁₂ alkylether, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂ alkyl or aryl group; and X is oxygen.

9. The compound of Claim 8 wherein at least one R²¹ comprises a cycloalkene oxide.

5

10. The compound of Claim 9 wherein each is R²¹ represented by the following structural formula:

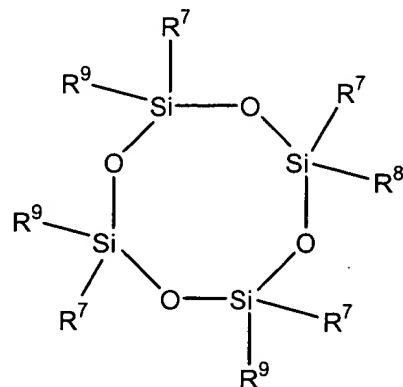


10

11. The compound of Claim 10 wherein: each group R¹⁵, R¹⁷, R¹⁸ R¹⁹, R²⁰ and R²² is a methyl group; each group R¹⁶ is an ethylene, hexylene, or octylene group; and R²³ is a hydrogen, hexyl, or alkylether.

15

12. A compound represented by the following structural formula:



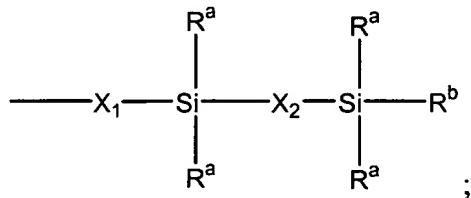
wherein:

each group R⁷ is an unsubstituted aliphatic group, a substituted aliphatic

group, an unsubstituted aryl group, a substituted aryl group;

each group R^8 is R^9 , hydrogen, an alkenyl, a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂-alkyl or aryl or $R^z-(O-Y_1)_m-$, $(R^z)_3Si-(O-Si(R^z)_2)_q-Y_1-$ or $(R^z)_3Si-(O-Si(R^z)_2)_q-O-$;

5 each R^9 is independently represented by the following structural formula:



wherein:

X₁ and X₂ are independently an inert linking group;

10 each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group;

each R^b is an aliphatic group substituted with an epoxide;

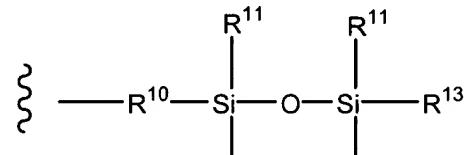
each R^z is independently a substituted or unsubstituted C₁₋₁₂ alkyl group, C₁₋₁₂ cycloalkylalkyl group, aryl substituted C₁₋₁₂ alkyl group or aryl group;

15 each Y_1 is independently a C₁₋₁₂ alkylene group;

m is an integer from 1 to 10; and q is an integer from 0 to 4.

13. The compound of Claim 12 wherein:

20 each R^7 is independently a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂ alkyl or aryl group;



each R^9 is represented by

each group R^{10} is independently a substituted or unsubstituted C₁₋₁₂

alkylene, C₁-12 cycloalkylene, C₁-12 arylalkylene, or arylene group, -Y₁-[O-Y₁]_p-, -Y₁-Si(R^z)₂-Y₁-, -Y₁-Si(R^z)₂-Y₁-O-Y₁-Si(R^z)₂-Y₁-, or -Y₁-Si(R^z)₂-Y₁-Si(R^z)₂-Y₁-,
each R^z is independently a C₁-12 alkyl group;

5 each Y₁ is independently a C₁-12 alkylene group;

each group R¹¹ and R¹² is independently a substituted or unsubstituted C₁-12 alkyl, C₁-12 cycloalkyl, aryl substituted C₁-12 alkyl group or aryl group; and

each group R¹³ is independently an epoxide substituted aliphatic group having from 2-10 carbon atoms.

10

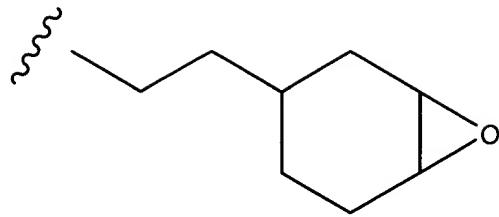
14. The compound of Claim 13 wherein:

R⁸ is substituted or unsubstituted C₁-12 alkylsilane, C₁-12 cycloalkylsilane, C₁-12 alkoxy silane, arylsubstituted C₁-12 alkyl silane or a substituted or unsubstituted 1-alkenyl group or a substituted or unsubstituted C₁-12 *n*-alkenyl group where *n* is greater than or equal to 1;

15 R¹⁰ is independently a C₁-12 alkylene, C₁-12 cycloalkylene, C₁-12 arylalkylene, or arylene group.

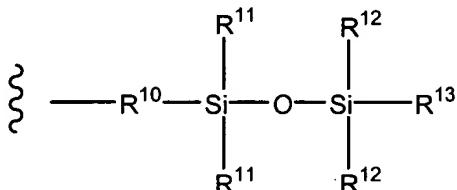
20 15. The compound of Claim 14 wherein at least one group R¹³ comprises a cycloalkene oxide.

16. The compound of Claim 15 wherein each R¹³ is represented by the following structural formula:



17. The compound of Claim 14 wherein:

5 R^7 is a methyl group,
 R^8 is ethenyl or R^9 ;



each R^9 is ;
each group R^{10} is $-(CH_2)_2-$, $-(CH_2)_6-$ or $-(CH_2)_8-$;
each group R^{11} and R^{12} are a methyl group; and
each group R^{13} is a 2-(3,4-epoxycyclohexyl) ethyl group.

10

18. A holographic recording medium comprising:

15 a) at least one polyfunctional epoxide monomer or oligomer which undergoes acid initiated cationic polymerization, wherein: 1) each epoxide in the monomer or oligomer is connected by a linker group comprising a siloxane to a silicon atom; or 2) each epoxide in the monomer or oligomer is connected by a linker group to a central polysiloxane ring; and each monomer or oligomer has an epoxy equivalent weight of greater than about 300 g/mole epoxide;

20 b) a binder which is capable of supporting cationic polymerization;
c) an acid generator capable of producing an acid upon exposure to actinic radiation; and optionally

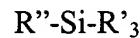
d) a sensitizer.

19. The holographic recording medium of Claim 18, additionally comprising a difunctional epoxide monomer.

5

20. The holographic recording medium of Claim 18, additionally comprising a monofunctional epoxide monomer.

10 21. The holographic recording medium of Claim 18 wherein the polyfunctional epoxide monomer or oligomer is represented by the following structural formula:

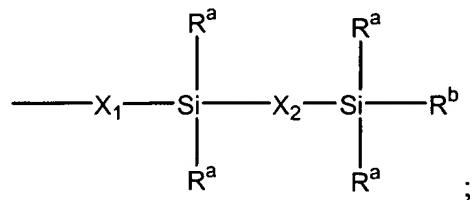


15 wherein each R' independently comprises an aliphatic group substituted with epoxide, said aliphatic group being connected to the silicon atom by a linker comprising a siloxane group; and

R'' is R' or $-H$, a substituted aliphatic group, an unsubstituted aliphatic group, a substituted aryl group, an unsubstituted aryl group a substituted siloxane group, an unsubstituted siloxane group, a substituted polysiloxane group or an unsubstituted polysiloxane group.

20

22. The holographic recording medium of Claim 21 wherein each R' comprises a group represented by the following structural formula:



25

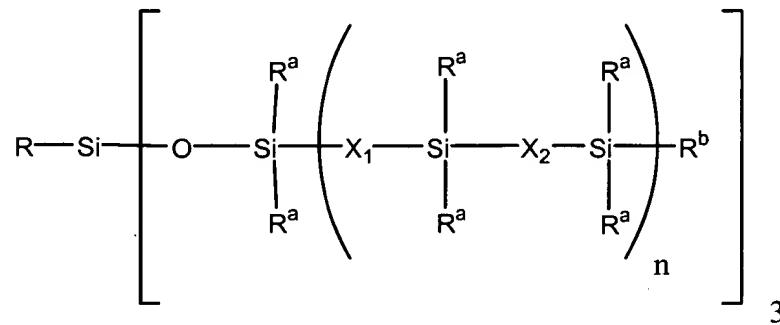
wherein:

X_1 and X_2 are independently an inert linking group;

each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group; and

each R^b is an aliphatic group substituted with an epoxide.

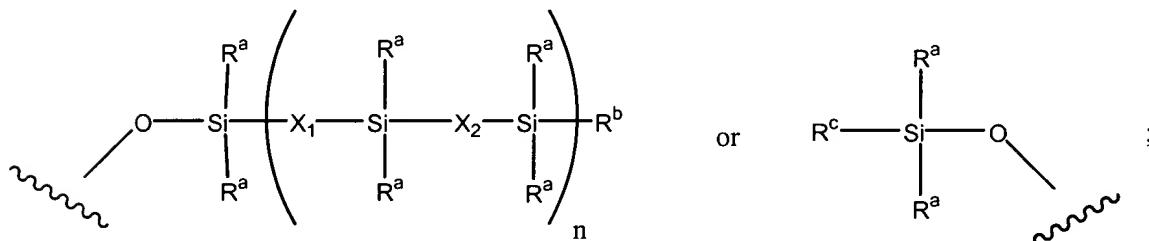
5 23. The holographic recording medium of Claim 18 wherein the polyfunctional epoxide monomer is by the following structural formula:



wherein:

10 X_1 and X_2 are independently each an inert linking group;
each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group;
 n is 1, 2, 3 or 4;

15 R is a substituted or unsubstituted aliphatic group, a substituted or unsubstituted aryl group or is represented by a structural formula selected from:

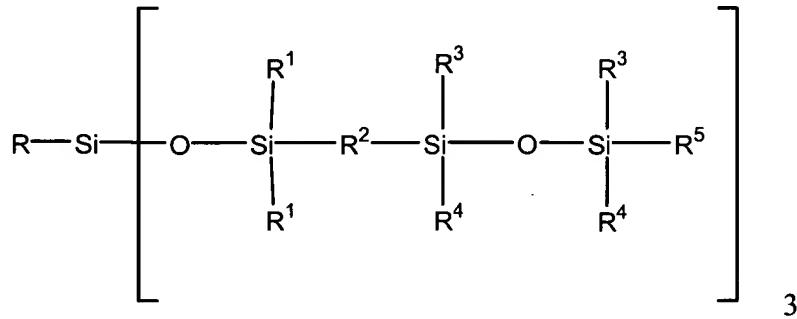


20 each R^b is independently an epoxide substituted aliphatic group; and
 R^c is H, an unsubstituted aliphatic group, a substituted aliphatic group, an unsubstituted aryl group, a substituted aryl group, a substituted siloxane group,

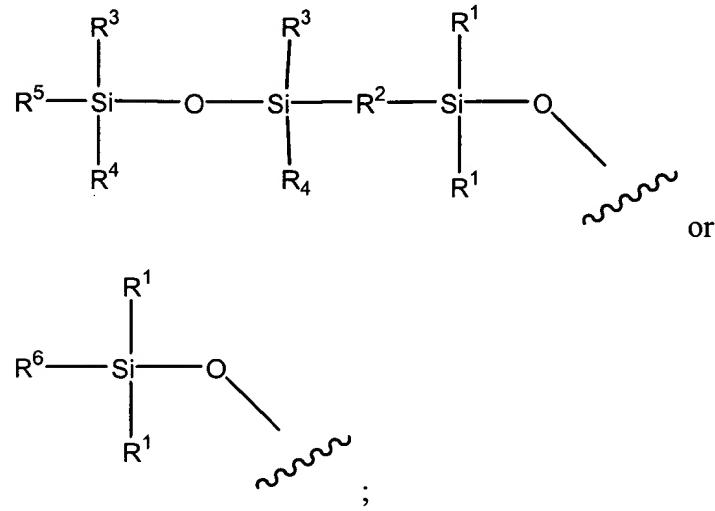
an unsubstituted siloxane group, a substituted polysiloxane group or an unsubstituted polysiloxane group.

24. The holographic recording medium of Claim 23 wherein the polyfunctional epoxide monomer is represented by the following structural formula:

5



wherein R is represented by a structural formula selected from:



10

wherein:

each group R¹, each group R³ and each group R⁴ is independently a substituted or unsubstituted C₁-12 alkyl, C₁-12 cycloalkyl, aryl substituted C₁-12 alkyl or aryl group;

15

each group R² is independently a substituted or unsubstituted C₁-12 alkylene, C₁-12 cycloalkylene, C₁-12 arylalkylene, or arylene group, -Y₁-[O-Y₁]_p-, -Y₁-Si(R²)₂-Y₁-, -Y₁-Si(R²)₂-Y₁-O-Y₁-Si(R²)₂-Y₁-, or -

Y_1 -Si(R^z)₂- Y_1 -Si(R^z)₂- Y_1 -;

each group R^5 is independently, an epoxide substituted aliphatic group having 2-10 carbon atoms; and

5 each group R^6 is independently hydrogen, an alkenyl, a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂-alkyl or aryl or R^z -(O- Y_1)_m-, (R^z)₃Si-(O-Si(R^z)₂)_q- Y_1 - or (R^z)₃Si-(O-Si(R^z)₂)_q-O-;

each R^z is independently a substituted or unsubstituted C₁₋₁₂ alkyl group, C₁₋₁₂ cycloalkylalkyl group, aryl substituted C₁₋₁₂ alkyl group or aryl group;

10 each Y_1 is independently a C₁₋₁₂ alkylene group;

p is an integer from 1 to 5; m is an integer from 1 to 10; and q is an integer from 0 to 4.

25. The holographic recording medium of Claim 24 wherein each group R^2 is independently, a substituted or unsubstituted C₁₋₁₂ alkylene, C₁₋₁₂

15 cycloalkylene, aryl substituted C₁₋₁₂ alkylene, or arylene group each R^6 is independently a monovalent substituted or unsubstituted C₁₋₁₂ alkylsilane, C₁₋₁₂ cycloalkylsilane, C₁₋₁₂ alkoxy silane, aryl substituted C₁₋₁₂ alkylsilane, a

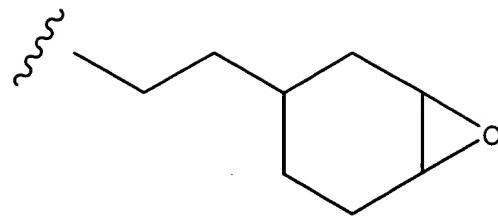
hydrogen, a vinyl, a monovalent substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂

20 dialkylether, (C₁₋₁₂ cycloalkyl)C₁₋₁₂ alkylether, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂ alkyl or aryl group.

25. The holographic recording medium of Claim 25 wherein at least one R^5 comprises a cycloalkene oxide.

25

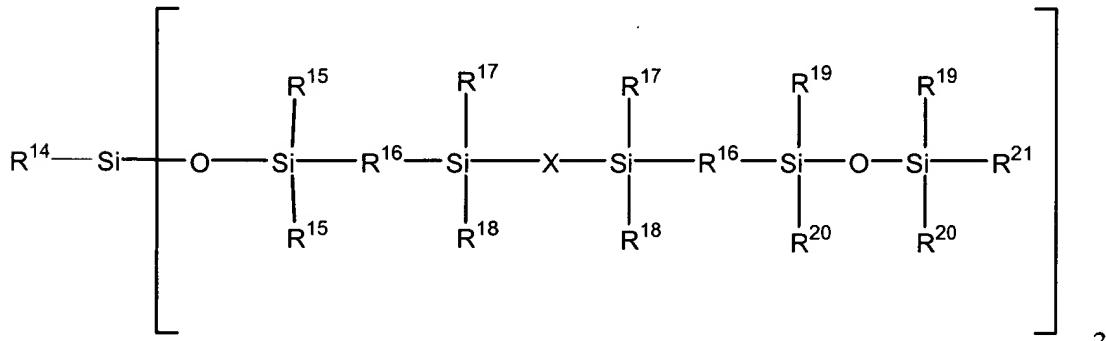
27. The holographic recording medium of Claim 26 wherein each R^5 is represented by the following structural formula:



28. The holographic recording medium of Claim 27 wherein R¹ is a methyl group; each group R² is an ethylene, hexylene, or octylene group; each group R³ is a methyl group; each group R⁴ is a methyl group; each group R⁵ is a 2-(3,4-epoxycyclohexyl) ethyl grouping, and each group R⁶ is a hydrogen or ethenyl.

5

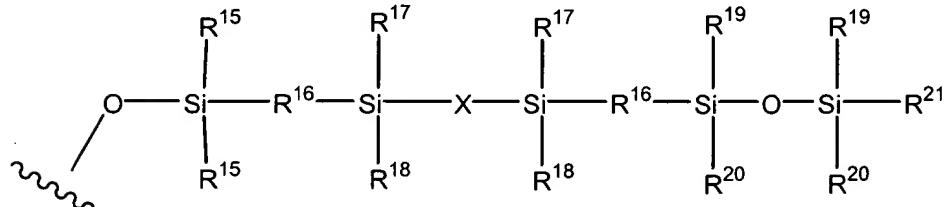
29. The holographic recording medium of Claim 23 wherein the polyfunctional epoxide monomer is represented by the following structural formula:



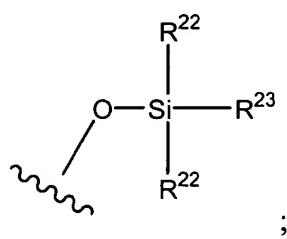
10

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wherein R¹⁴ is represented by a structural formula selected from:



or



each group R¹⁵, each group R¹⁷, each group R¹⁸, each group R¹⁹, each group R²⁰ and each group R²² is independently a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂ alkyl or aryl group;

each group R¹⁶ is independently a substituted or unsubstituted C₁₋₁₂ alkylene, C₁₋₁₂ cycloalkylene, C₁₋₁₂ arylalkylene, or arylene group, -Y₁,

5 -[O-Y₁]_p-, -Y₁-Si(R^z)₂-Y₁-, -Y₁-Si(R^z)₂-Y₁-O-Y₁-Si(R^z)₂-Y₁-, or -Y₁-Si(R^z)₂-Y₁-Si(R^z)₂-Y₁-,

each R²¹ is independently an epoxide substituted aliphatic group having 2-10 carbon atoms;

10 R²³ is independently hydrogen, an alkenyl, a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂-alkyl or aryl or R^z-(O-Y₁)_m-, (R^z)₃Si-(O-Si(R^z)₂)_q-Y₁- or (R^z)₃Si-(O-Si(R^z)₂)_q-O-;

each group X is independently oxygen or R¹⁶;

each R^z is independently a substituted or unsubstituted C₁₋₁₂ alkyl group, C₁₋₁₂ cycloalkylalkyl group, aryl substituted C₁₋₁₂ alkyl group or aryl group;

15 each Y₁ is independently a C₁₋₁₂ alkylene group;

p is an integer from 1 to 5; m is an integer from 1 to 10; and q is an integer from 0 to 4.

20

30. The holographic recording medium of Claim 29 wherein each group R¹⁶ is independently a substituted or unsubstituted C₁₋₁₂ alkylene, C₁₋₁₂ cycloalkylene, C₁₋₁₂ arylalkylene or arylene group; R²³ is, independently, a hydrogen, a monovalent substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ dialkylether (alkyl-O-alkylene-), C₁₋₁₂ cycloalkyl C₁₋₁₂ alkylether, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂ alkyl or aryl group; and X is oxygen.

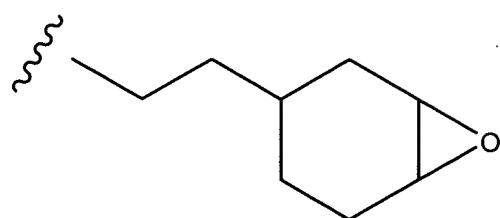
25

31. The holographic recording medium of Claim 30 wherein at least one

R^{21} comprises a cycloalkene oxide.

32. The holographic recording medium of Claim 31 wherein each is R^{21} represented by the following structural formula:

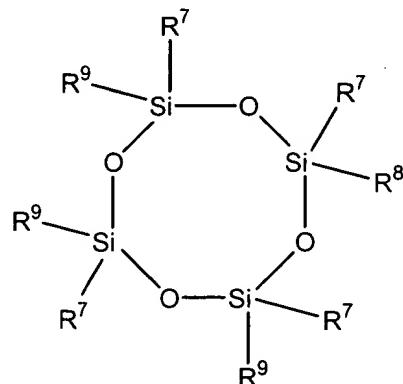
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33. The holographic recording medium of Claim 32 wherein each group R^{15} , R^{17} , R^{18} , R^{19} , R^{20} and R^{22} is a methyl group; each group R^{16} is an ethylene, hexylene, or octylene group; and R^{23} is a hydrogen, hexyl, or alkylether.

10

34. The holographic recording medium of Claim 18 wherein the polyfunctional epoxide monomer is represented by the following structural formula:



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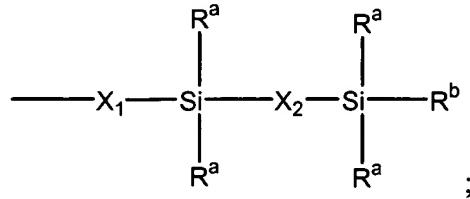
wherein:

each group R^7 is an unsubstituted aliphatic group, a substituted aliphatic group, an unsubstituted aryl group, a substituted aryl group;

each group R^8 is R^9 , hydrogen, an alkenyl, a substituted or unsubstituted C1-12 alkyl, C1-12 cycloalkyl, aryl substituted C1-12-alkyl or aryl or

$R^z-(O-Y_1)_m-$, $(R^z)_3Si-(O-Si(R^z)_2)_q-Y_1-$ or $(R^z)_3Si-(O-Si(R^z)_2)_q-O-$;

each R^9 is independently represented by the following structural formula:



5

wherein:

X_1 and X_2 are independently an inert linking group;

each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group;

each R^b is an aliphatic group substituted with an epoxide;

each R^z is independently a substituted or unsubstituted C₁₋₁₂ alkyl group, C₁₋₁₂ cycloalkylalkyl group, aryl substituted C₁₋₁₂ alkyl group or aryl group;

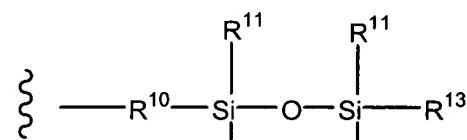
each Y_1 is independently a C₁₋₁₂ alkylene group;

m is an integer from 1 to 10; and q is an integer from 0 to 4.

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35. The holographic recording medium of Claim 34 wherein the polyfunctional epoxide monomer is represented by the following structural formula:

each R^7 is independently a substituted or unsubstituted C₁₋₁₂ alkyl, C₁₋₁₂ cycloalkyl, aryl substituted C₁₋₁₂ alkyl or aryl group;



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each R^9 is represented by

each group R^{10} is independently a substituted or unsubstituted C₁₋₁₂ alkylene, C₁₋₁₂ cycloalkylene, C₁₋₁₂ arylalkylene, or arylene group, $-Y_1-[O-Y_1]_p-$, $-Y_1-Si(R^z)_2-Y_1-$, $-Y_1-Si(R^z)_2-Y_1-O-Y_1-Si(R^z)_2-Y_1-$, or

$-Y_1-Si(R^z)_2-Y_1-Si(R^z)_2-Y_1-$;

each R^z is independently a C1-12 alkyl group;

each Y_1 is independently a C1-12 alkylene group;

p is an integer from 1 to 5;

5 each group R^{11} and R^{12} is independently a substituted or unsubstituted C1-12 alkyl, C1-12 cycloalkyl, aryl substituted C1-12 alkyl group or aryl group; and

each group R^{13} is independently an epoxide substituted aliphatic group having from 2-10 carbon atoms.

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36. The holographic recording medium of Claim 35 wherein:

R^8 is substituted or unsubstituted C1-12 alkylsilane, C1-12 cycloalkylsilane, C1-12 alkoxy silane, arylsubstituted C1-12 alkyl silane or a substituted or unsubstituted 1-alkenyl group or a substituted or unsubstituted C1-12 n -alkenyl group where n is greater than or equal to 1;

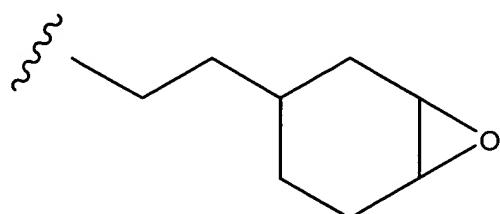
R^{10} is independently a C1-12 alkylene, C1-12 cycloalkylene, C1-12 arylalkylene, or arylene group.

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37. The holographic recording medium of Claim 36 wherein at least one group R^{13} comprises a cycloalkene oxide.

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38. The holographic recording medium of Claim 37 wherein each R^{13} is represented by the following structural formula:



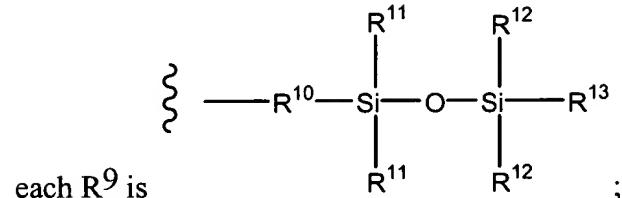
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39. The holographic recording medium of Claim 38 wherein:

R^7 is a methyl group,

R^8 is -ethenyl or R^9 ;

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each group R^{10} is $-(\text{CH}_2)_2-$, $-(\text{CH}_2)_6-$ or $-(\text{CH}_2)_8-$;

each group R^{11} and R^{12} are a methyl group; and

each group R^{13} is a 2-(3,4-epoxycyclohexyl) ethyl group.

10 40. The holographic recording medium of Claim 19 wherein the difunctional epoxide monomer is represented by the following structural formula:



where each group R^{24} is a 2-(3,4-epoxycyclohexyl)ethyl grouping; each grouping R^{25} is a methyl group, and each group R^{26} is a methyl group.

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41. The holographic recording medium of Claim 18 wherein the holographic medium comprises between about 0.25 to about 5 parts by weight of the difunctional epoxide monomer per part by weight of the polyfunctional epoxide monomer.

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42. The holographic recording medium of Claim 18 wherein the holographic medium comprises from about 90 parts binder and 10 parts monomer or oligomer (w/w) to about 10 parts binder and 90 parts monomer or oligomer (w/w).

43. The holographic recording medium of Claim 18 wherein the acid generator capable of producing an acid upon exposure to actinic radiation is a diaryliodonium salt.
- 5 44. A holographic recording medium of Claim 18 wherein the sensitizer is 5,12-*bis*(phenylethynyl)naphthacene.